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Thank you Courtney, for that very, very thoughtful introduction, and thank you to the Space Foundation for the opportunity to join you all here this morning and to be a part of this particular symposium.

It is really exciting to be here and to be a part of this community. I have to tell you though, Ed, the way you ought to do these events is to make sure you put the warm up act first, and then do the main event. Because we got this reversed, I'm the warm up act. Courtney was the main event here. He really is an extraordinary gent. A fellow I'm privileged to serve with, and a guy that has a tremendous amount of background in this community. As I think there are so many folks who are involved in it, I think that he articulated that point very well. Who are stakeholders in it? What it is we do, and what we do on behalf of the American people. He understands and appreciates every dimension that makes up this community, and for that I am grateful everyday for his guidance, as well as stewardship in this capacity.

Among the other stakeholders involved and folks that are deeply essential I think to the activities we do every single day. Many of them were honored yesterday by some very eloquent words that General Eberhart offer on behalf of the military astronauts and their contribution over the storied 44 years of this great agency and amazing accomplishments that they have brought to us and continue to do this day.

I think Ed hit it right on the nose. These are really remarkable people. One after another, you can't be more impressed with their capabilities, and the one common denominator they all share is that they have resumes that look like they are the amalgamation of three or four different people. It's just stunning - - the kinds of backgrounds they all have. Many of them we're fortunate enough to have within NASA's leadership, as well work with them regularly throughout the National Security community, when the opportunity presents itself for transitioning back and forth between the various institutions.

In that regard, what I thought was particularly poignant yesterday, in General Eberhart's commentary and video he presented, was the cooperation that exists between all four military services. It certainly speaks volumes about the activities and "jointness" of the projects at NASA, not only on a military dimension but also on an international dimension - - what we are doing this moment on International Space Station.

There are 10 folks that are in space right now aboard the International Space Station. Three permanent residents: a Navy commander, an Air Force colonel, and their Russian commander. They are joined by the seven members of the STS-110 crew, commanded by an Air Force Lt Colonel and piloted by a Navy commander. It's just amazing to see the caliber and capacity of people who are involved in these activities.

As I mentioned to General Eberhart yesterday, in that type of environment, there exists all the great elements of joint operations, as well as the understanding other service cultures and also the dimensions of international cooperation. These understandings are the very things we sought to emphasize when Goldwater – Nickels was enacted back in the mid-1980s, with a heavy and very healthy element of service rivalry.

In that vein, the gent that is now the Associate Administrator for Space Flight is a very good friend that I've come to admire and enjoy dealing with a great deal. Retired Air Force Col. Fred Gregory, is an accomplish astronaut in his own right. With several missions on his resume, he was the safety and mission assurance leader for NASA for many years and is now the Space Flight Associate Administrator.

His position is concerned about the space station, shuttle operations, and all the dimensions that are supported so impressively by this industry. He is very much of an Air Force pedigree, no doubt about it. I will advise you on this Ed, that there is still a very alive and well inter-services understanding. We went through a series of resumes for selection of a new program executive officer for the International Space Station. The new program executive officer for ISS will be used organization-wide to really bring the emphasis to that particular initiative, and to make sure that it is coordinated with all the activities throughout NASA, in addition to the engineer challenges involved.

Each of the resumes described these incredibly impressive people, all of which have the common denominator of being former Air Force. I said, "Fred this is really impressive. This is amazing, and I'm struck by the fact that they all happen to come from this same type of culture." Fred knew very well about my naval service pedigree and background, and he didn't miss a beat when he said, "We don't need no stinking navy guys."

So the understanding is very strong. It's still there, and its still very much active. It's even a healthy one. I think it really draws on the greatest collaboration of what we see and do, both throughout the military services and the larger aerospace community. In addition to these important people with military training aboard shuttle today, we also have three folks with a doctorate in physics, astrophysics and I think the third was in physiology. So as a consequence, all of them are bringing a different dimension or knowledge to the occasion. They are just absolutely impressive.

One of the other gents, who I think should be to be heralded because of this historic mission that's happening right now, is Col. Jerry Ross. Col. Ross is a fellow who is making history starting today, having linked up with International Space Station yesterday. He's about to embark on his eighth and ninth spacewalk efforts during this mission, and this mission is his seventh mission on the space shuttle. As a matter of fact, he has flown on all five of the Space Shuttles over the course of that time. He's an extraordinary gent, a fellow with a tremendous background, and now he will hold the distinction of the only individual alive who has served this many times, on this many missions and be in space seven consecutive times.

I talked a minute ago about International Space Station, and how I think we're going to look at how this organization wrestles with some of the major challenges that clearly dominate the discussion of what we do and what we are involved in throughout NASA. Nonetheless, the challenges are very much a management issue, and one I think it will be dealt with very appropriately by the organizational structure that I referenced a moment ago. Fred Gregory has championed the cause of establishing a program executive officer along the lines of what we've seen successfully done, in the national security institutions, and establish this position in a way that will bring a discipline to the process that is both management focused, as well as all the interrelated elements that need to come to bear on it. In so many ways, the

International Space Station is not a program per se, it is a very integral part of what we do throughout NASA in many different dimensions. It pertains to biological and physical sciences and research objectives we want to accomplish, and in that regard, the space flight objective, Earth science issues and all of the other enterprises we engage in, have a bearing and an opportunity to use this unique capability and infrastructure in a way that has to be very, very creative and done right. So as a consequence, we have focused on the near term objective to deliver a capability that fulfills our ambition and dreams.

In that regard I am very much influenced by those who I consider mentors and friends and folks who have had a professional influence on me during the course of my professional time. Chief among them is the Vice President, in terms of approach and the focus that he's taken. Through the course of his career, of which the most dominate characteristic of what he advocates, has bearing and application on what we do at NASA and throughout the larger aerospace community.

In the time he served as Secretary of Defense, he was of the view that the decisions you make in a certain capacity have less bearing on the immediacies or near term challenges you face today, but instead the decisions have profound bearing on that which you will affect in the future. The decisions, issues, problems and questions that agencies have, that the Department or Cabinet officers face, typically will roll out and have their consequences long after they left their opportunity to serve. So in that regard, he was always driven by the proposition, of whatever the near term, closest dog to the sled, kind of challenge that certainly had to be dealt with. Always keep your eye focused on what the larger, long-term future may or should be in order to accommodate that larger set of objectives. If you don't do it, what you are condemned to deal with is a repetition of what you do today.

In that regard, I have found that to be a very important lesson of thinking not only managerial about what the challenges we face day in and day out, which confront us all in the aerospace community, and certainly the topics of this symposium touch on so many of those and have bearing in that regard. The larger set of objectives you need to think about are what our largest strategic objectives should be, what the future we would like to have looks like, and how we can shape that today. Indeed, it is our legacy. The decisions we make today and the things we do now, will have greater bearing on where we will be 10, and 20 and 30 years from today in a more profound way than anything else. We are at a certain point. I'm convinced, we're at a very critical cross road in the agency history, as well as in the aerospace community at large.

In the conversations I've had with Chairman Bob Walker and the space commission, they discussed the activities they are engaged in now, and I think the activities reaffirms my view. We are really very much at a seminal juncture right now, and the question is how we will proceed ahead and establish what that future set of objectives will be. So in that respect I'm struck by a very common, commentary that I have heard in the course of my vast experience now of three and one-half months at NASA. It is a repetitious. It is a theme I hear regularly, and everyone thinks what we really need to do is to think about how we recapture the spirit of exploration that was at the very origins of the agency when it was founded.

This spirit indeed dominated the first 15 to 20 years in history, in a way so vivid that all of us, as Americans remember. Across the globe, to recall what accomplishments and amazing capabilities and opportunities that were present as a consequence of conquering those

technology limitations that existed, to achieve something that we thought was impossible is now frequently missed. In my judgment the spirit is misconstrued as a objective and a quest to achieve the arrival and a destination. If we are really honest with ourselves, it was less about the destination, and it was a lot more about sending messages to others on this planet. Messages about what our capabilities could be, were, and should be in terms of removing obstacles and having the ability to do things to avoid threats to ourselves as Americans.

As a consequence of the Cold War legacy, we set a number of early accomplishments that sent a powerful message to others who live on this planet of what we were capable of doing. In a way, it was driven by exploration, but it was also driven by the message we wanted to send. A powerful message in terms of what we thought our standing was in the world, and in that regard, it was an even greater accomplishment than the achievement of arriving at a single destination in 1969. The evidence is what we see going on right now on International Space Station, absolutely phenomenal.

The notion that we would have a constant, permanent present in space with international flare is amazing. The presence, is commanded by a Russian. He was dedicated to the challenge, not more than 15 years ago, of responding to what his country perceived was a threat from the United States. Now, Yuri Onufrienko is working in cooperation, with a Navy commander and an Air Force Colonel as the crew of Expedition Four right now. That's an amazing accomplishment and development. One that is truly the outgrowth and the by-product of what we were able to accomplish in that early period of NASA's history.

The question is how do we define what we would like things to look like, and what will we likely be capable of doing in a similar period of time that fast forwards us as many years as those early legacies. In 20 to 30 years from now, how do we accomplish that? What is the legacy that we will leave in that regard? We can debate and probably have a referendum all day long on what our favorite kinds of objectives would be. It would be defined as some by destinations, some by accomplishments in other areas, but by the end of the day what I think we will all decide at this juncture, at this moment, is that we are limited by our present technology, and these limitations preclude us from accomplishing almost any of the objectives that we can talk about today.

So the part of the strategic objective I think that is pertinent for the aerospace community and NASA specifically, not only in the near-term, is to focus and concentrate very specifically on the technology enablers you would need to make any of those objectives possible. When you fry it down to those common denominators, it comes down to a couple of very key critical issues.

First, in the very near-term I think what we need to see and what we are certainly working on with the aerospace community at large, is reusable launch vehicles. Having spent the better part of yesterday with General Eberhart and Under Secretary Teets and working through those kind of questions, I am very confident that we have the capacity to understand and meet those kinds of near term requirements, but the objectives are by definition more near term. The ones I think we need to concentrate on to enable the technology and to accomplish the next series of steps, would come thereafter.

Our ability and capacity to deploy, explore and discover is limited. It not so much our ability to get to exo-atmospheric or within earth's lower orbit. Goodness gracious we can do it in

eight and a half minutes right now. So our focus ought not to be to fry down or decrease the amount of time that it takes to accomplish that task. It's more how do you do it with lower risk, a greater safety margin, greater reliability, and greater capacity? We need the means to accomplish a wider range of objectives, so once you get to space its utility is of a wider purpose.

But for our objectives, and for other communities and institutions, it also turns on the proposition of what do you do once you arrive at that point. A navy commander, Bob Purvey, describes launch as the equivalency of what it feels like in that eight and a half minutes. It's a functional equivalency of sitting at a stop sign minding your business and having a 18 wheeler jam back into you at 80 miles an hour and carry you forward without any control on your part for eight and a half minutes. You are going to go where it wants you to go and that's going to be the end of it. It's probably about the most apt description that I have been given for exactly what that experience must be like, and they have attest to that it is like.

But once there, we move at speeds that are slightly faster, either manned or unmanned, at about the same speed that John Glen did on Friendship 7 forty years ago. That's it. That's as quick as we know how to travel to a destination right now. The technology limits us to that capacity, that 18,000 miles per hour, but given the vast expanse of just this solar system, you can forget about the universe. We can't achieve any of those objectives in a period of time that would be sufficient to inform today's researchers about what we may want to seek, explore, discover and expand our knowledge of where we live. In that regard, the basic limitations we have today, if we would decide at this moment, at this juncture to get about the business as expeditiously as we possible can would overwhelming.

To reach the farthest end of this solar system, the best we can do based on all the planning and horizons involved, we can maybe get a probe there by 2017. We are limited by technology because we have under that X stamp of technology opportunities we have today.

We have to meet a series of gates very quickly and at just the right time. You will have the full knowledge that by the time you achieve your destination to the farthest edge of our own solar system, it will offer you the opportunity for roughly 4 to 6 weeks worth of really quality imagery to study and debate more than what we can do today. Now, the information on our time limitation is really quite stunning commentary. We would have to wait for at least 15 year intervals to get about it by 2006, so we would meet the perfect alignment of planets to catch the sling shot effect. Oh, by the way, this objective is going to inform the agenda in 2017 for a span that may last for to six weeks. That's inadequate, and not because the nature of the mission is not useful or that the objective is not noble. It's a very useful one, and it's one that the National Academy of Sciences considers to be important exploration objective.

The fact of the matter is we're banking on the proposition that things will remain precisely the same between now and that date. Somehow the research agenda will be the same, and so therefore we'll benefit from what it is that we'll know in that very short span of time, after 15 years. Again if you consider the technology advances that have occurred in the course of the previous 15 years, there is no way that we can reasonably assume that things will look the same. Indeed it is the equivalent of re-introducing a leadite view of where it is we think we are, or where we'll be in 15 years. Our focus needs to be as a technology enabler. How do you provide power generation, propulsion capabilities to achieve that distance and expanse

of time? Is there a reasonable period of time to inform the agenda, exploration, and discovery purposes in a way that is efficient?

We're looking at a whole range of different opportunities. I mean there is going to be a renewed set of objectives, and I've been talking to Ron Saga, the director of the defense research and engineering at the Defense Department, which is pursuing very similar objectives and power generation, propulsion capabilities. We need to do this in a way that can yield some solution sets that would meet both of our objectives in a very useful way. We're not just going to wait for that research to yield something, let's pick today, now.

We need to ask what is the most promising, most mature of the technology we know of right now, and lets pursue it with great vigor. Is the most promising technology at this juncture nuclear propulsion? We already know about the capacity to use nuclear power as a means to propel at greater rates and speeds, but it also provides more on station and on orbit time for any variant we would send anywhere in a period of time that would inform the agenda. Progress has been made in this area. Particularly, progress has been made as a means of power generation alone, and it has been extremely impressive. Typically, it is viewed as very risk adverse, extremely conservative and a very limited kind of linear thinking industry.

Now my dad was an acolyte of H. G. Rickover back in the late 50's and early 60's. He spent an entire career as a nuclear submariner. I grew up around the dinner table listening to the complication of this, and I can tell you, it was at times tedious. Every question I ever asked him was always to be solved with a slide rule and that was it. In the end what they managed to do, even without that very extreme focused thinking was to accomplish a feat that really is quite remarkable. In the early days, Rickover was the first to be successful in gaining support as well as the deployment of nuclear propulsion capabilities abroad in navy vessels.

The capabilities needed to be quartered in size, in the area that was roughly the equivalent of a bowling alley to put 8 nuclear reactors in, and they all celebrated that the fact that it would lasts 18 months without refueling. It required a lot of room, and it didn't provide much capacity for very long. Today, over a span of 35 years what we see at this juncture is a reactor that can fit into a industrial dumpster, and it provides the capacity for the full life of any submarine for more than 40 years without refueling. The power generation capabilities and means to do that have become more compact, and the result at the end of the process is more powerful.

Even though the very linear, very safety conscience and extremely risk adverse kind of view still dominates as part of our culture, thankfully within that particular community, the care and attention to detail has also yielded 40 years of operational experience which is flawless. As a consequence we know how to work with this technology, and it is just a matter of trying to figure it out of how to make it more compact. Hey, we don't need nearly the power generation or propulsion capacity that is residence within those amazing capabilities the nuclear navy operates today. It's simply taking it to the next couple of levels in the next generations of design, and figuring out how you employed that capacity, which we have already demonstrated as being able to be achieve within industry as well as the community in which it operates. This is doable in my mind. It is achievable, and it is something that we need to dedicate ourselves to now.

As a result in the budget for fiscal year of 2003 that's being presented and considered by the Congress right now, is an aggressive initiative of nearly a billion dollars to pursue this particular opportunity. It will be followed by a series of enhanced, very aggressive approaches, and again, I hope that we can develop in concert with our National Security partners in this regard. We want to explore other opportunities for power generations and propulsion means. These are the primary technology enablers that we need for the purpose of really of pursuing the exploration and discovery objectives, and it will allow us to get past the limitations that has been residence and persistence with us for better than 40 years.

It has a greater effect in the human dimension. Today, our other limitations of traveling to any destination we could collectively pick, if we were able to reach that consensus miraculously at such an impressive symposium and group as we have here, would be the human effects. What happens to humans, to these extraordinary people that I extol at the beginning of this commentary, who are there for extended durations? The effects on human beings are really quite profound, and we're not really fully aware of the effects of what could be there that would have potential negative impacts on human beings.

The opportunity for human exploration is something that must always be preceded by the means to probe and explore through robotic devices. Robotics offer a range of other opportunities that we would have to aggressively pursue in order to understand fully what the consequences will be of human exploration, and what precautions we ought to take for the preservation of human life in that pursuit of exploration and discovery. In that regard, one of the fundamentals, the most basic things that we don't know how to deal with right now are the effects of radiation.

What we have learned in the last year, as a consequences the Mars odyssey probe, is that the radiation effects between here and Mars are at least three times what our International Space Station crew is experiencing right. Now, the radiation the space station crew is experiencing today is something that gives us cause for constant consideration, so that it is not high enough to compromise their safety as well as their human condition when they return to Earth. I think we're satisfied that we're working through that, and we've done it in a way that's responsible, as well as responsive to the set of challenges that are there. Something that is three times the exposure rate is not something that we know how to conquer at this juncture today, at this point.

So therefore the more we know about this the more we can continue to probe this opportunity, and we can gather the information and enable the technologies to achieve the set of objectives we'll need. The combination of human effects and the propulsion initiative I spoke about the moment ago are very closely related. There is more than one concern. It's not the amount of exposure, as in what amount or how much radiation you received? It's also over what duration. In what period of time and to what extent can we conquer these barriers? If we limit the exposure to a very limited period of time by getting wherever you want to go faster,t means we have the opportunity for greater dimensions of human as well as a full range of other explorations and discovery opportunities. Both of these are extremely doable objectives, and objectives we must concentrate on. This will be the legacy we'll leave for that condition within not only the larger community but also with NASA specifically, a decade from now and longer. And that's important.

Lastly I simply want to discuss one last item and I'll conclude. It is along the way in meeting what is describe here as the requirements for enabling technologies. To achieve our objectives and be wide eye about it, to understand exactly what those implications are, to conquer those objectives, and to overcome those limitations is what will continue to inspire every successive generation to want to do the same. In this regard we have a rather challenging circumstance.

As General Eberhart very aptly stated this yesterday in his commentary, and two folks of the space foundation reminded him this morning, his observations were generated by a lot of thought and discussion from a survey among elementary schools kids. The survey occurred over the the past several years, and it was an aid in determining what is it that really inspires youngsters the most. The results, as General Eberhart described them yesterday was dinosaurs of which we're not going to resemble and space exploration. Those are the two things that excite kids the most, and yet somewhere along the way we lose their interest. As it was pointed it out to me this morning, if we don't capture that interest, inspiration and zeal for space exploration, and continue it past that elementary stage, it just withers away. We see a continuing trend in that direction.

Today it's increasing at an alarming rate. It's at the point where the number of folks within the community that pursue science, math, engineering and technology objectives are more limited today than what we're seen in the last 40 years. So the goal is to inspire the next series of generations who would take on this set of pursuits that we have obviously dedicated ourselves to, and it speaks volumes to the attendance of this symposium and its focus. Clearly this is an important calling and important objective that we are all dedicated to. How do we assure that next series of generations will bring not only the enthusiasm for it but the competency to master, tackle and overcome the technology challenges that I have outline here today? In that regard, what I'm hoping to do here in the next course of foreseeable weeks ahead, is to outline a very comprehensive strategic objectives for where NASA will go.

I can preview, as a coming attraction that I will be focusing specifically the objectives of inspiring the next generations in a very concerted way, and it will be viewed as a core or essential mission element of what we do at NASA. Our efforts will be a joint strategic plan in coordination with the Department of Education, and the plan will complement a larger set of federal initiatives that we are pursuing for math and science education objectives, particularly targeted at that range of K through 12. Through this pursuit, I think we are assuring that we have folks who are equally dedicated to the challenges as those assembled here today and throughout the aerospace community. We must pursue these important objectives for the generations to come, and to do it with greater enthusiasm and confidence, so they may completely remove the barriers and challenges that we've been wrestling with and trying to overcome for so many years.

I thank you all for your attention. I appreciate the Space Foundation's very thoughtful invitation for me to be here, and it's a great, great opportunity to be a part of this community.

Thank you all very much.

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